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ABSTRACT

The literacy demands encountered in schools are considerably different from those encountered in the workplace. Existing measures used to analyze literacy demands and abilities in the workplace are not suitable for analyzing the same demands and abilities in schools. Methods that are effective for general job analysis can be specifically applied to the literacy aspects of jobs. Two screening methods used by employers to assess job literacy abilities are the cloze procedure and the more effective, though more time consuming, job problem solving simulations. Business and military trainers are faced with the problem of trying to improve worker performance through literacy and basic skills training. Evidence suggests that job performance may be more closely related to metacognitive aspects of literacy than to the basic literacy abilities of achieving simple comprehension or communicating simple messages. Trainers wishing to improve the literacy job performance of workers can use literacy task analysis to help determine the metacognitive skills employed by superior workers. Interviews focusing on how superior workers make literacy-related decisions is an effective method of determining important skills needed by new and less competent employees. These skills can then be taught to less competent workers. (YLB)

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LITERACY TASK ANALYSIS:
DEFINING AND MEASURING OCCUPATIONAL LITERACY DEMANDS

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American Educational Research Association Convention
Chicago, Illinois
March 31, 1985

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There is a considerable gap between the literacy demands encountered in schools and those encountered in the workplace (Mikulecky, 1981; 1982). Unlike school literacy, over 80% of workplace reading and writing serves the purpose of helping to accomplish specific tasks (Sticht, 1975; Diehl and Mikulecky, 1980; Mikulecky, 1982). In addition, even though most workers are involved with literacy activities for several hours each work day (compared to about 90 minutes for students in school), it is rare for workers to read or write without interruption for as long as 60 seconds at a time. Reading, writing, doing, asking questions, and listening are integrated in completion of work tasks (Mikulecky and Winchester, 1983; Mikulecky and Ehlinger, 1985).

The problem of analyzing literacy demands and abilities in the workplace is, thus, a good deal more complicated than analysing the same demands and abilities in schools. In schools, where most reading is "reading to learn" from textbooks, one can determine material difficulty using a variety of readability formulas and methods of discourse analysis. Reader comprehension can be assessed using an even wider variety of formal and informal reading ability measures (Farr, 1969; Pikulski and Shanahan, 1982) . Similarly, several specific and global measures exist for assessing the quality of traditional written compositions. In the workplace, the problem is more complex. The researcher must first determine how much of the material is actually read, how the material is used, and the processes involved in using a manual, filling out a form, following a diagram, or completing the multitude of literacy-related job tasks. Editing a brief telex memo or

filling in a few blanks on a form may involve a good deal more language processing than composing a two page essay on one's personal experiences.

Literacy Task Analysis

Trainers in business, government and the military have developed effective techniques for task analyzing jobs to determine key tasks and the competencies related to those tasks (Miner and Miner, 1977, pp.162-168; Beatty and Schneier, 1981, pp. 79-83; and U.S. Dept. of Labor, Handbook for Analyzing Jobs, 1972). These methods generally involve on-site:

* Observation of job occupants,
* Interview of job occupants,
* Examination of job descriptions,
* Examination of work materials, and
* Performance (with questioning) of work activities.

These methods, effective for general job analysis, can be specifically applied to the literacy aspects of jobs. For example, the results of a partial literacy task analysis of one of the key functions of an entry level word-processing specialist job follows below.

(See Figure 1)

(Figure 1)
LITERACY TASK ANALYSIS
Entry Level Word Processing Specialist

FUNCTION: I. Setting up and entering a job.

Key Literacy Task Descripion	Related Literacy Competencies
I-1 Reviews job ticket to note type of job, originator and turnaround time, and job specifications including special instructions for format, typeface, and editing. If hard copy source document, scans for any illegible information and, where necessary, contacts originator's secretary for clarification. When other than standard work, may discuss with originator most effective format for desired document according to its purpose and use.	1.1 Read and comprehend written instructions concerning job specs. 1.2 Determine appropriate document format and style using manual. 1.3 Effectively frame questions to elicit needed additional information over phone. 2.1 Apply and use company's style manual.
I-2 Keys appropriate functions to set up margins, type, spacing, and special features, according to document specifications on job ticket or standard style and format guidelines.	2.2 Use manual, logic, and inference to solve non-standard problems. 2.3 Performing computations centering and spacing.
I-3 Proofs stored information using CRT and edits for grammar, spelling, punctuation, verb/subject agreement. (For magnetic typewritters, proofs after printout.)	3.1 Perceive verbal detail and differences between original copy and text. 3.2 Read and comprehend final text. Check meaning of sentence and paragraphs. 3.3 Proficiently apply grammar, spelling, and punctuation. 3.4 Apply company style and fomat guidelines to text.

Screening

Many employers are concerned about the economic and human cost of literacy related mistakes on the job. The Wall Street Journal (January 22, 1981) cites industry reports which indicate increased economic problems resulting from workers unable to meet the basic skill demands of their jobs. William Barnes, vice-president of finance of JLG Industries reports that "poorly educated workers are our no. 1 problem, the main factor slowing our growth." JLG reports having spent over one million dollars to correct worker literacy mistakes. Mutual of New York reports "an estimated 70% of the insurance firm's correspondence must be corrected or retyped at least once." Safety concerns over workers not being able to read warnings and follow written directions have been issues in a growing number of court cases and have lead to several firings at Westinghouse Electric Corporation's defense gear plant in Sunnyvale, California. U. S. Employers in auto industries are replacing unskilled workers with robots following the Japanese lead. Larry Vickery, G.M.'s director of employee relations, reports that GM currently employes one skilled worker for every 5.6 assembly line workers and projects a one-to-one ratio before the end of the 1990's.

Respondents in the Center for Public Resources (1982) survey were concerned about costly one-time mistakes resulting from low worker literacy levels. Examples cited include workers killed because of inability to read warning signs, costly mistakes made because of inability to comprehend correspondence, and time lost through the need to give regular lectures in the use of equipment as opposed to simply providing workers with written step-by-step instructions. Low ability levels in applied computation and measurement, according to respondents,

regularly accounted for losses in production, quality, and general corporate performance (p.20).

In Griggs vs. the Duke Power Company (1971), the Supreme court ruled that any literacy tests used for employment screening must be clearly job related. Research has since supported the wisdom of this decision. Workers often score from one to two grade levels higher when reading familiar job related material than they do when reading general passages such as newspaper stories (Mikulecky, 1982).

Cloze Procedure: The cloze procedure measures the ability of the reader to understand the sentences of a passage at a literal or factual level. To construct a job related cloze test, a copy is made of material (at least 150 words in length) which is clearly used in job performance. After an introduction of 25 words or so, every fifth word should be blanked out. The job applicant's ability to accurately replace blanked out words can be used as an indication of ability to comprehend the material at a basic level (50% replacement is considered excellent). The percentage of correct replacements can be converted to grade level equivalents using Bormuth's (1975) tables. The tests should be given to current workers on the job to determine performance expectation levels. The degree to which entry level screening scores are set below the scores of current workers can be determined by the amount of training time available for new workers to achieve average performance levels. If only a short training time is available, it is not advisable to set performance cut offs more than two to three grade levels below the level of current employees. Longer training time can allow the acceptance of less literate entry level workers. Two samples of job related cloze tests are found below. See Figures 2 and 3.

(Figure 2)

OPERATION AND CONTROL

Controlling Spooling

One of the functions which the VM/370 system operator often controls is spooling.

What makes an operator the "Spooling Operator"? People who have Class D command privileges are spooling operators.

What is their job? Figure 3.9 on the following page illustrates some of the things which a spooling operator is called upon to do.

Look at the person placing the deck of cards into the card reader. The spooling operator should verify that a user ID card precedes any deck of cards sent to the machine room by a user. The ID card will cause the deck to be placed into the user's virtual card reader (that is, space on a spool disk).

The spooling operator also is _____ to maintain a supply _____ blank cards in the _____ for the card punch. _____ the card punch run _____ of cards, an intervention _____ message will appear on _____ system console.

In addition _____ keeping a supply of _____ cards in the card _____, the spooling operator must _____ provide the proper paper _____ the printer(s). This may _____ between normal stock paper _____ special forms required for _____ purposes. When the latter _____ the case, the spooling _____ is also responsible for _____ the loading of the _____ buffer, forms control buffer, _____ controlling the printing of _____ which require special forms.

_____ are a series of _____ D CP commands for _____ and determining the status _____ spool files. Upon determining the status the spooling operator can then stop, start, restart, or rearrange the sequence in which spool files will be printed or punched.

Finally, the spooling operator is responsible for separating punched and printed output according to user identification. Later we will take a look at some of the CP commands which pertain to the spooling operator.

DIRECTIONS: (Figure 3)

The following passage is to help us find out how easily you can handle the type of reading you may have to do during your training and on the job. Take a moment to look at the sele tion. Notice that many words have been replaced by blanks. Read the selection carefully. Fill in every blank with a word that makes the most sense. Don't worry if you aren't sure about all of your choices, you don't have to get every one correct.

Xerox 860 Operator Manual

THE REFERENCE GUIDE

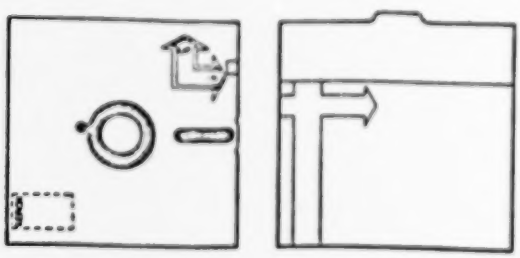
To go along with the manual there's a Reference Guide. This is an additional source of information about the 860 Information Processing System.

In your Reference Guide _____ find instructions on how _____ change print wheels, install _____ ribbons, even how to _____ diagnostics to check out _____ system.

There's also a section _____ the messages you'll see _____ the screen. Should the _____ display a message that's _____ to you you can _____ look it up in _____ Reference Guide.

TRAINING DISCS

The 860 _____ discs to record all _____ information. The illustration below _____ a disc and a _____ jacket. When you're not _____ a disc, keep it _____ its jacket.



Though the cloze procedure is a recognized and accepted method for determining reading ability, it does have some drawbacks for use in assessing job literacy abilities. It is incapable of assessing non-textual material, such as diagrams and charts, and it loads heavily on the syntactical aspects of language capability. A reader who is unfamiliar with Standard English syntax is likely to perform less well on a cloze test than a speaker of Standard English. In addition, a good deal of work related reading is comprised of brief passages of less than 100 words. The brevity of such passages limits the context available to the reader and therefore also limits the effectiveness of the cloze procedure.

Job Problem Solving Simulations: A more effective, though more time consuming, method for assessing job literacy abilities is through use of literacy related problem solving simulations. Using actual materials from the workplace, the trainer can assess the job applicant's ability to solve job problems which call for the use of literacy skills. The simulations can be used in two ways. They can be given to current workers to gather base line data for determining cut off scores. A second and potentially more effective method is to develop two very similar simulations. After the job applicant has performed the first simulation, he or she can be informed of mistakes and allowed to try the second simulation. A considerably higher score on the second simulation is an indication of a new employee who is able to learn rapidly. Samples of literacy related job problem solving simulations are found below.

(See Figures 4 and 5)

6.5 WATCH DOG TIMER

Another protection circuit is found on the Word/Card Decoder PC Board. The circuit shown in Figure 6.7 monitors a signal called WCSTB (Word/Card Strobe) which is essential to correct system operation. See Section 8.0 for function of the WCSTB signal. If the WCSTB signal is not generated at least every other Interrupt, then the one shot will time out, and relay 1CR will be dropped out. Light emitting diode 1LT will turn off when this occurs. The contacts of 1CR opening will cause the Emergency Stop Reset relay 3CR to drop out, placing the machining center in emergency stop.

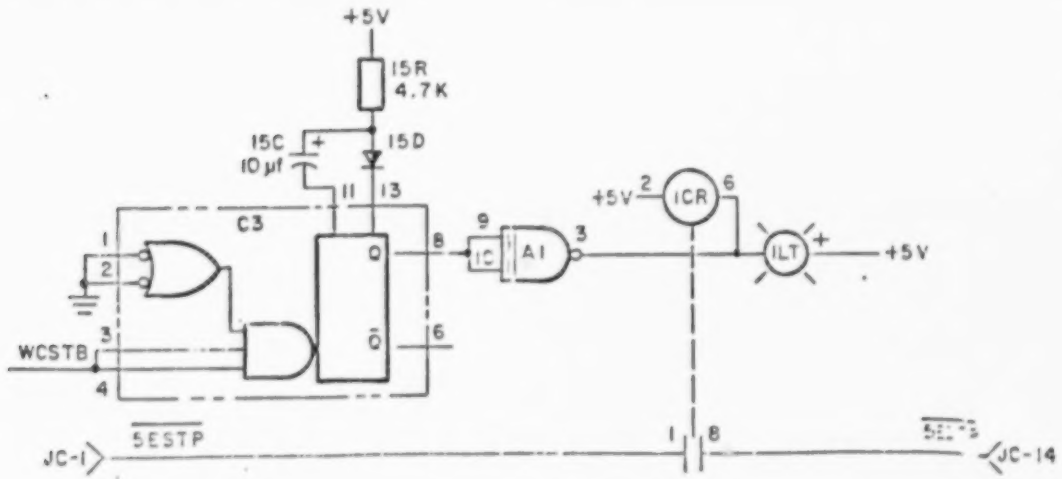


Figure 6.7 Watch Dog Timer

PROBLEM:

Without the use of test equipment, how could you tell if 1 CR is energized or not?

(Figure 5)

Directions:

This report contains some mistakes in grammar and punctuation. Carefully read through the report. Draw a circle around each mistake you find then correct each mistake.

I. COMPARISON OF WARD AND INDUSTRY SALES BY MATTRESS SIZE

The following table shows, by size a breakdown of mattress sales for Ward (August 1980 YTD) and the industry (1976, 1977, 1978). All of these figures were provided to us by sealy.

Table I

SALES BY SIZE OF MATTRESS

	Industry			Ward
	1976	1977	1978	YTD
Twin Mattress/Foundation	39%	40%	35%	47%
Full Mattress/Foundation	36	35	35	33
Queen Sets	18	18	22	14
King Sets	7	7	8	6

From this figures, we see that larger size mattresses are becoming increasingly important to the industry, particularly the queen size. We also notice that Wards sales mix is concentrated in the smaller sizes to a much greater degree than the industry. We gets more than our share of the twin market, but far below our share of the queen market.

With the growing importance of larger mattress sizes, these figures could be ominous for Ward Efforts need to be made to capture our share of the larger mattress sizes. This might require a change in our merchandising presentation, particularly if the consumers perceives the purchase of a larger mattress as a major investment. In that case, price might not be as important a feature in the purchase decision.

Analysis of Literacy Strategies to Improve Worker Performance Through Training.

As the workplace becomes more complex, it is more and more difficult for employers to simply "cream off" the best workers. Training of employees at all levels is required. A survey of Fortune 500 comporations revealed that over 2/3 are involved in literacy training programs that ranged from improved reading and writing efficiency for managers to basic skills courses for entry level workers (Mikulecky and Cousin, 1982). The Center for Public Resources Survey (1982) reveals 75% of respondents reporting some basic skills training.

Business and military trainers are faced with a difficult problem in trying to improve performance through literacy and basic skills training. The link between job performance and literacy abilities is a subtle link. Research about the relationship of literacy to job performance is sketchy and based, to a large extent, upon information obtained from military studies. Kulp (1974) found, in a controlled study, that performance of an assembly task decreased significantly when worker reading skills were more than two grade levels below the difficulty level of instructions. Kern (1980) found that use of print materials was much more likely among inexperienced workers performing tasks than among more experienced workers. Sticht (1975) in Reading for Working, reports correlations of measured reading ability to Job Sample performance that range for r=.26 to r=.37. These correlations are significant, but only explain from 8% to 13% of the job performance variance. A good deal more than basic reading ability as measured by a reading test is needed to explain job performance ability.

Mikulecky and Winchester (1983) report mixed results in their study of nurse literacy factors analyzed by job performance and experience levels. Nurses were rated and ranked by job performance into superior, competent, and adequate categories. No significant differences among performance groups were noted in measured literacy abilities or observed practices. However, interview data did reveal significant differences among nurses in perceived purposes for job literacy use and recognition of how to determine which literacy strategies to employ in specific contexts and situations. Metacognitive awareness and reported practice of metacognitive strategies like self-questioning, focusing on key ideas, and setting purposes for literacy use were more prevalent among superior job performing nurses than among adequate job performing nurses. Mikulecky and Elhlinger (1985), in a study of literacy and job performance among electronic technicians, confirm the strong relationship of metacognitive literacy use to job performance.

Metacognition: During the last few years, research in the area of problem solving has become part of the discussion of literacy abilities. Meyers and Paris (1978) use the term "metacognition" to denote higher level activity which serves the function of coordinating and directing thinking behavior. In addition to direct involvement in cognitive aspects of completing a task, individuals often form plans, generate hypotheses, check progress, evaluate results and generalize behavior. Most information processing models (e.g. Atkinson and Schiffrin, 1968; Butterfield and Belmont, 1975; and Sternberg, 1980) include executive components or strategies such as those listed above.

Brown (1982) and Baker and Brown (1984), in relating metacognition to reading, list several metacognitive skills. Among these are the

abilities to 1) clarify purposes, 2) focus attention to key aspects, 3) engage in questioning, and 4) take corrective action when failure of comprehension is occuring. Flower and Hayes (1981), in presenting a process approach to composition, emphasize the executive and monitoring aspects of the writing process. Competent writers have clear senses of audience, relevant background information, and multiple purposes for the final written product.

Evidence suggests that job performance may be more closely related to metacognitive aspects of literacy than to the basic literacy abilities of achieving simple comprehension or communicating simple messages. Trainers wishing to improve the literacy job performance of workers can use literacy task analysis to help determine the metacognitive skills employed by superior workers. These skills can be taught to less competent workers.

Metacognitive Interview Samples: An interview focussing on how superior workers make literacy related decisions is an effective way to determine what important skills are needed by new and less competent employees. The simple literacy task analysis (See Figure 1) provided indicators of what literacy skills are required for effective job performance. Such indicators are sufficient for screening. If employee performance is to be improved, however, trainers need to also know how superior workers use these skills.

Below are samples of three metacognitive literacy interviews from a sales job, a special projects maintainance worker job, and a secretarial job. Task analysis revealed these three activities to be key aspects of

the selected jobs and interviews with supervisors indicated that the performance of many workers was deficient on these tasks. Information gathered from interviewing superior performers can be used by trainers to improve the overall job performance and productivity of less competent workers.

Designing effective telex messages is an important literacy task for some sales personnel. Telex messages used to relay information to overseas offices in written form which is less expensive than telephone, and to do it in as few words as possible. The specific audience is the sales department in the company's overseas office. The process involves writing, reading, and editing. The metacognitive interview helps the trainer determine the thought processes new workers must be taught and the skills they will need to develop.

SAMPLE

ATTN: PAT GREENE

THKS INFO

DELAY SEEMS TO HV OCCURED IN US - CLD YOU PLS CONTACT DHL MILWAUKEE AND CHECK ON FLIGHT DEPARTURES - PERHAPS THESE POUCHES SHLD BE COLLECTED EARLIER.

PLS ADVISE FINDINGS

REGARDS,

CC: RSVK
GRA

LITERACY PROCESSES	METACOGNITIVE SKILLS INVOLVED
Initially I consider who could help me determine the reason for the delay in receiving pouches? What department? What country? What person specifically?	Consider problem and resources. Inventory background info.
I need to check on and locate where delays are occuring between Milwaukee and our foreign devisions; relay the information in as few words as possible; and direct the message to the people who are most likely to be able to help solve the problem.	Define Purpose and specific multiple goals of task.

The message is written but it's too wordy and, therefore, would cost too much to send by Telex. It needs to be revised and abbreviated.	Monitor process of literacy task. Focus and evaluate in terms of standards.
I need to consider how the mail is delivered using pouches; where delays could possible occur; and how to abbreviate words for a Telex.	Consider background if job and knowledge of abbreviation. Focus on key aspects.
What needs to be done? I need to make the Telex message briefer while still relaying the necessary information. I need to locate the problem in deliveries.	Organizing Ideas
It's important that this message gets to the person who can help me solve the problem, that it be written in as few words as possible, and that it be processed and received soon. I also need an immediate response so I'll be friendly and polite.	Goal Setting Consider all purposes and audience
The message is rewritten in its abbreviated form.	Application of literacy skills
Does the Telex meet the goals? Is it readable? If not, should I revise it? Perhaps I should check with Sue on any ideas she may have on where the delays are occuring or who I should contact.	REVIEWING Evaluating Revising

HOTEL CONFERENCE CENTER

Convention Dept.

Nicholet Room

Program _____

Contact person _____

Day _____ Date _____ Time _____

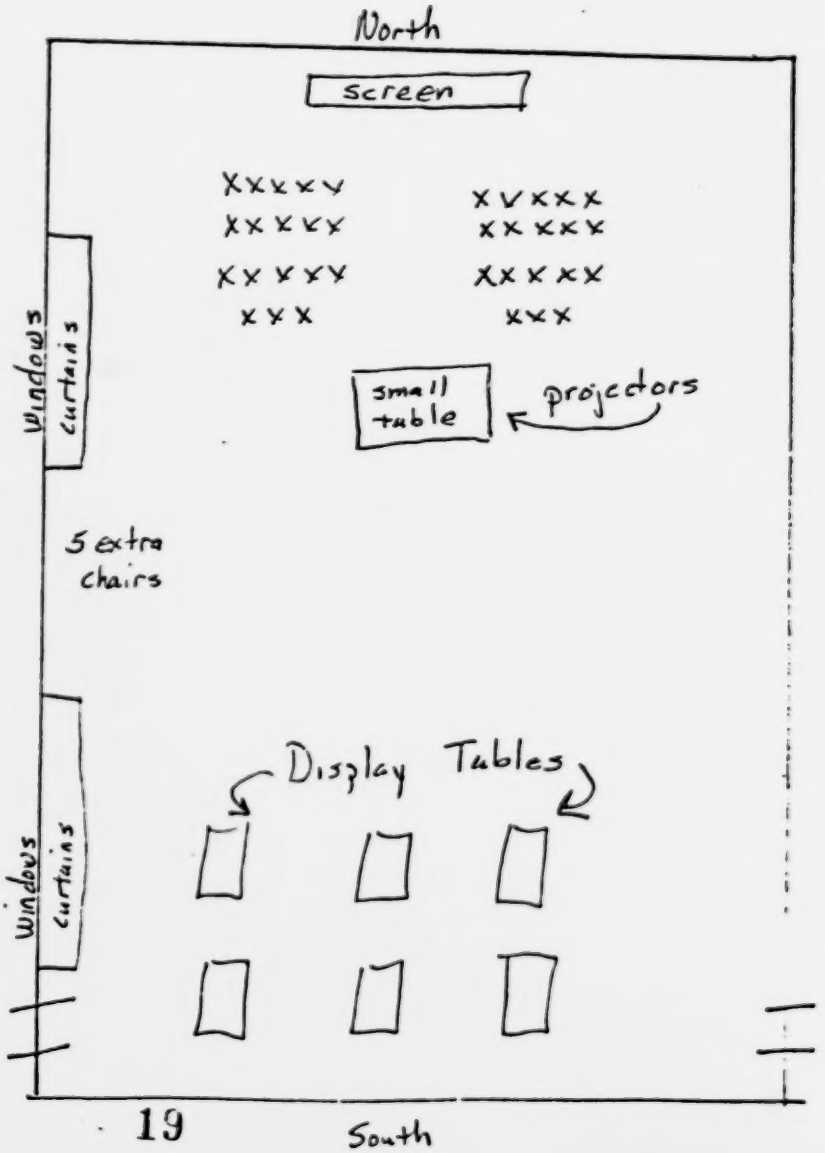
Room Capacity _____

A.V. Equipment:

overhead projector
film projector
cassette player
screen
small table for projector

OTHER:

5 extra chairs
check that curtains close completely
6 display tables



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Set-up Chart Example

Room set-up charts used by maintenance personnel at a hotel convention center are examples of workplace reading. The information on the chart is used to prepare a room for a meeting. The process is fairly complex and mistakes cause a good deal of problems and extra work. Knowing how superior workers "read" the charts can be useful in training new and less effective workers.

LITERACY PROCESSES	METACOGNITIVE SKILLS INVOLVED
Initially I consider what it is I need to accomplish and when it needs to be completed. Do I have enough information on the form and set-up chart to be able to correctly set-up the room?	Clarify purposes Self question
I need to set up the room as indicated on the set-up chart; locate the necessary equipment; and complete it in time for the meeting.	Organize and categorize sub tasks.
I know where I can locate the A.V. material and all of the furniture except for a table for the projectors. I need to find something else to use.	Regular self monitoring and focus on new key aspects.
I not only need to know how to read the chart, I need to know the terms for the A.V. materials and where to find them.	Requires both special chart skills and knowledge of workplace.
What needs to be done? I need to get the room set up as indicated on the chart and need to find an alternative for the A.V. small table. Systematically check placement using chart. Check equipment.	Organizing Ideas Monitoring progress Focus on each key detail

Secretarial Typing and Editing Example

New York Mutual Life reports 70% of its correspondence need to be retyped (Hymowitz, 1981). Nearly every recent survey of business literacy problems refers to the problem of producing accurate correspondence. This interview with a superior secreatry give indications of how it can be done correctly.

LITERACY PROCESSES	METACOGNITIVE SKILLS INVOLVED
This is a handwritten letter from Susan. I have to go through it quickly since Susan only works 1/2 days and will soon leave. I circle any problem areas.	Define Purposes Focus on key problems Monitor using notes
I have trouble reading Susan's handwriting so I look for words I can't figure out from context right away. I rewrite these in my own handwriting for faster typing later.	Anticipate problems Have plan of strategies.
I also look for missing words. Susan had "that be" and I changed it to "that would be." I knew that "would" was missing from the context of the sentence. and that Susan often skips words.	Monitoring meaning Using background information
My biggest problem when reading over letters and memos are technical words. I need to double check those.	Focus on key aspect Self monitoring
People in this office have real problems with possessives (like its and it's), so. I always look for those.	Consider background
I also look for run-on sentences. The people who write them don't mean to run-on; they're just thinking and writing at the same time.	Apply background knowledge
If the letter's not technical, I proof it while it is still in the typewriter The mistakes are likely to be typographical. For technical material, I take it out and proof it line by line comparing the typed version to the original. I don't catch technical mistakes just	Adjusting strategy to material

reading for meaning.	
I think I have a little checklist in my head. It contains things like checking names and addresses, making sure I have all enclosures, and making sure everything is there.	Organizing Self Questioning and self monitoring

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